|  |  |
| --- | --- |
| Outcomes Being Tested | Your Score out of 4 |
| 0.1 |  |
| 0.2 |  |
| 0.3 |  |
| 0.4 |  |
| 0.6 |  |
| 1.1 |  |

**Predictions: *Energy Flow***

(1).When you make mistake when writing with a pencil, you can rub an eraser over the writing to get rid of it. Are you using energy while you erase? Explain your answer.

(2).List at least two, easily- measured changes in your body occurring in your body while you are erasing that could be used to figure out if you were using energy during the erasing process.

(3).Take the list (from #(2) above) and predict how you think these will change as you erase.

|  |  |
| --- | --- |
| Possible Change in my Body that I could measure | What I think the change will be  (increase in, decrease in, etc) |
| 1. |  |
| 2. |  |

Do you think the temperature of the paper or the eraser changes while you are erasing? *If so, explain why you think the temperature of the paper or eraser will change. If you think there will be no change in the temperature of the paper or eraser, explain why you think this.*

**Sketch** a graph of the temperature of the eraser vs. a person’s heart rate while erasing. *(Pay special attention to the shape of your graph and to whether your graph intercepts an axis. Getting the numbers right is not important.)*

Eraser Temperature

Heart Rate

LIST EVERYONE IN YOUR LAB GROUP:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Focus Questions**:

**Hypothesis**:

**Procedure***:*

**Data Table**:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Number of Rubs | Room Temp. (°C) | Max  Temp. (°C) | Rest Heart Rate (BPM) | Final Heart Rate (BPM) | Rubbing time (s) |
| **25** |  |  |  |  |  |
| **50** |  |  |  |  |  |
| **75** |  |  |  |  |  |
| **100** |  |  |  |  |  |

**Calculations**: *You must figure out how many calories were being used by the person who was doing the rubbing. You will put your answers to the calculations in the* **“Calculations Table”** *below.*

**(1).First,** calculate ΔT = Max Temp – Room Temp (record this answer in the ∆T column)

**(2).Second**, calculate heart rate change during the activity. (Final HR – Rest HR) you need this number for the information below.

**A.** If change in HR is greater than 60 calculate Calories used using the following formula

Cals used = (.26 Cal/s) x Rubbing Time (s)

**B**. If change of HR is less than 60 calculate Calories used using the following formula

Cals used = (.093 Cal/s) x Rubbing Time (s)

The answer you get should be recorded in the calories used column of the data table (below).

**Calculations Table**:

|  |  |  |
| --- | --- | --- |
| Rubbing time (s) | ΔT (°C) | Calories used (show calculation) |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

**Analysis**:

Construct 2 graphs:

Graph 1 number of rubs vs. ΔT

Graph 2 number of rubs vs. calories used

**Analysis Questions**: (Answer on a separate sheet of paper)

1. On your graphs what is the independent variable and how do you know?
2. On your graphs what were the 2 dependent variables and how did you know?
3. Calculate the slopes of your two graphs **and** describe their meaning.
4. What causes the temperature of the metal to rise? Give evidence.
5. Is there a relationship between the number of rubs and the temperature change of the metal? Give evidence
6. Is there a relationship between number of rubs and Calories used? Give evidence
7. Is 0,0 a good point on either of these graphs? Explain
8. Why do most mechanical devices that have moving parts need oil or grease to help them work? Give examples.
9. The principle in this experiment is that energy transferred by human beings is converted into heat by friction. There is always friction between two sliding surfaces. How do you think the result would have changed if the metal surface were rubbed with a piece of cloth? Explain.
10. How is this lab similar to and different from the “step lab” that we just completed?

**Conclusion:**

*Revisit your prediction page, explain if you were right or wrong and why you were right or wrong, make sure to use numerical evidence in your explanation. Discuss the data you collected, what are the relationships in the data, what was happening? Discuss the major energy concepts in this lab and how you knew we were using energy. What did you learn in this experiment?*